



Lecture:

Inflammation.

Inflammation

- Inflammation is a defensive process that a living body initiates against local tissue damage. It takes the form of a complex reaction of blood vessels, certain plasma components and blood cells, and cellular and structural components of connective tissue, which dilutes, destroys, or isolates the causative agent.
- Terms ending in the suffix “-itis” denote inflammation.

Etiology of Inflammation

- An inflammation may be triggered by several mechanisms. These include:
 - — Noxious physical agents;
 - — Noxious chemical agents;
 - — Accumulated products of metabolism;
 - — Immunologic tissue injury;
 - — Tissue injury from infection;
 - — Tissue necrosis.

Inflammation is classified
according to duration:

- acute inflammation,
- chronic inflammation.

according to predominant
reaction in vascularized tissues:

- exudative inflammation,
- proliferative inflammation.

Inflammation

ACUTE INFLAMMATION

Historically, inflammation has been referred to as either acute or chronic inflammation, depending on the persistence of the injury, its clinical symptomatology, and the nature of the inflammatory response. The hallmarks of acute inflammation include

- (1) accumulation of fluid and plasma components in the affected tissue,
- (2) intravascular stimulation of platelets, and
- (3) presence of **polymorpho-nuclear leukocytes**. By contrast, the characteristic cell components of chronic inflammation are lymphocytes, plasma cells, and macrophages.

Inflammation has three major **components**
(or stages):

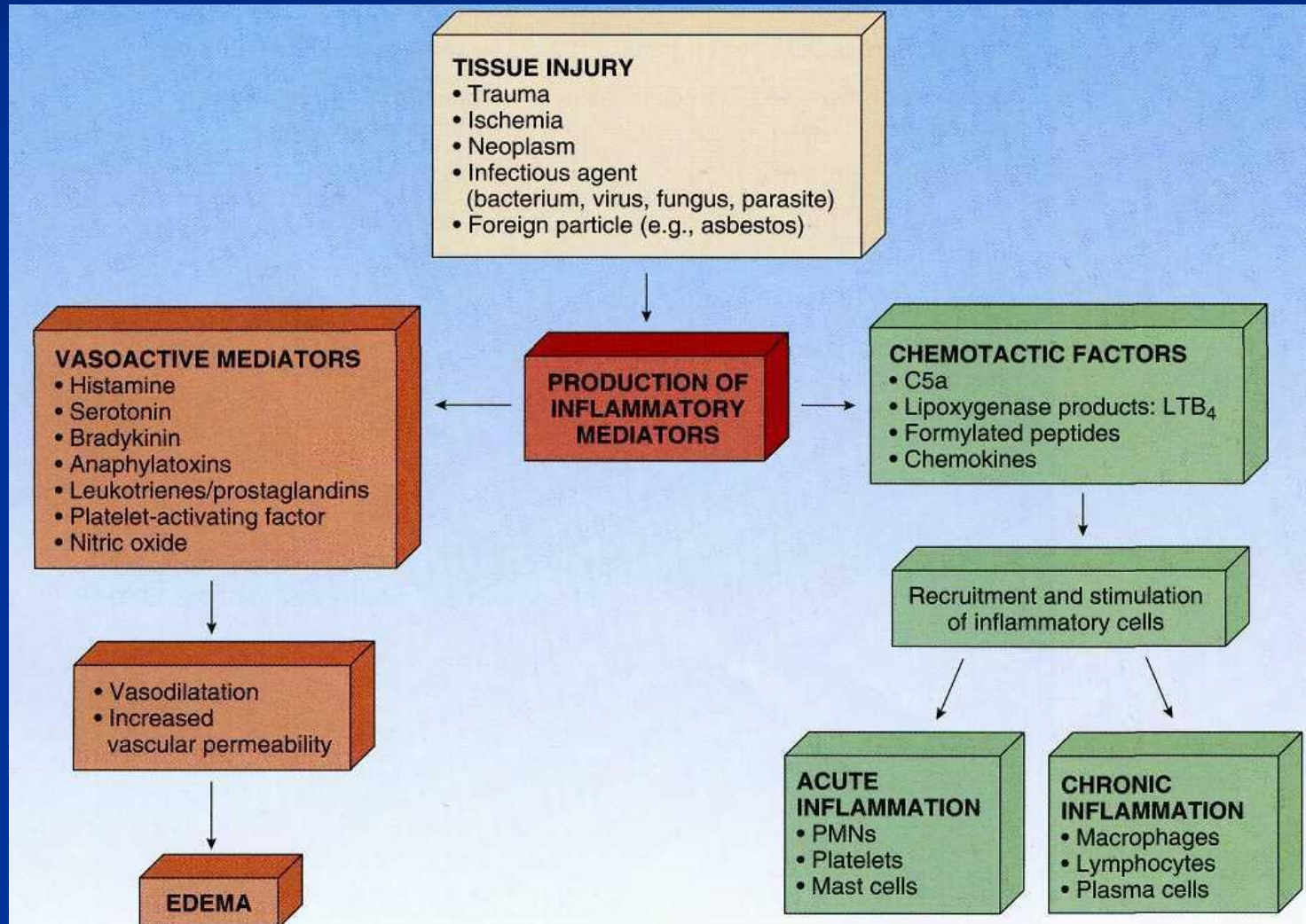
Alteration of vascular caliber and structural changes in microvasculature.

Exudation, increased vascular permeability, emigration of leucocytes from microcirculation to the focus of injury.

Proliferation of connective tissue cells and cells of parenchyma to restore injury.

Inflammation

Specific inflammatory mediators produced at the sites of injury regulate this response of the vasculature to injury.



- The exudative stage of inflammatory reaction consists of these formal pathogenetic elements:
 - — Changes in microcirculation;
 - — Changes in permeability;
 - — Leukocyte transmigration.

Inflammation

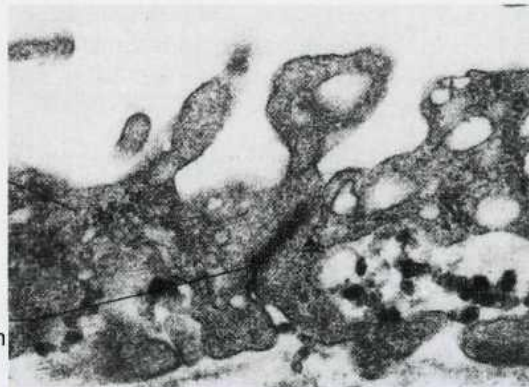
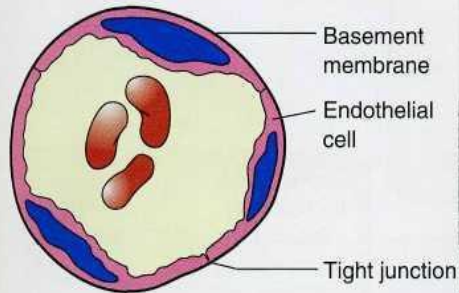
Following to a tissue injury, changes in the structure of the vascular wall lead to:

- Loss of endothelial cell integrity
- Leakage of fluid and plasma components from the intravascular compartment
- Emigration of both erythrocytes and leukocytes from the intraluminal space into the extravascular tissue.

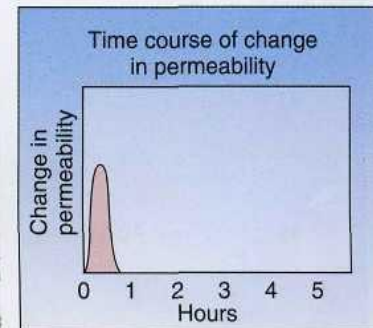
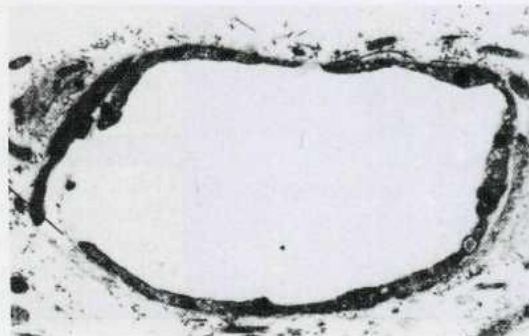
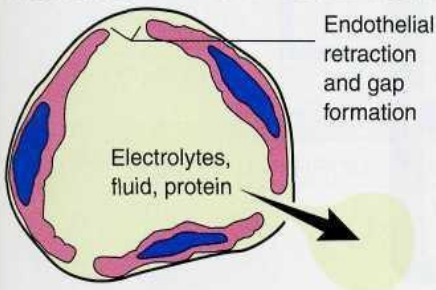
ACUTE INFLAMMATION

Inflammatory Edema

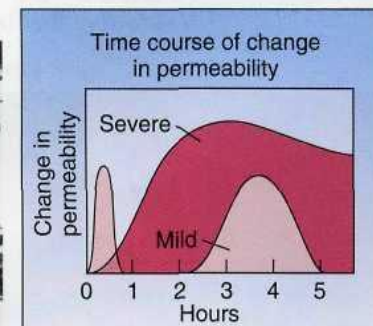
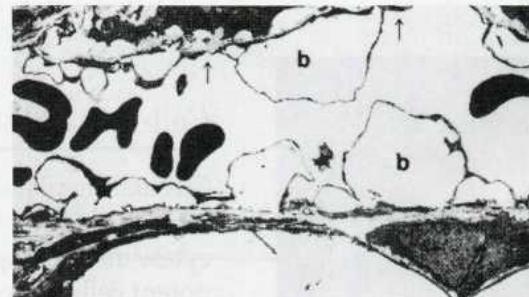
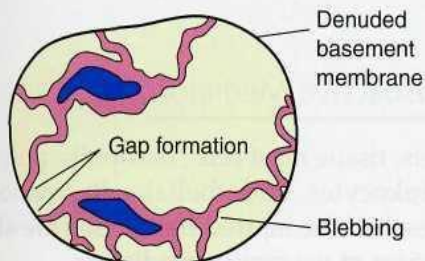
NORMAL VENULE



VASOACTIVE MEDIATOR-INDUCED INJURY



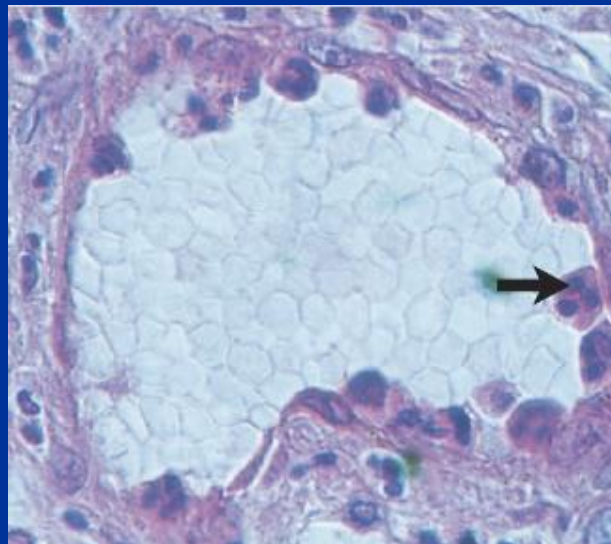
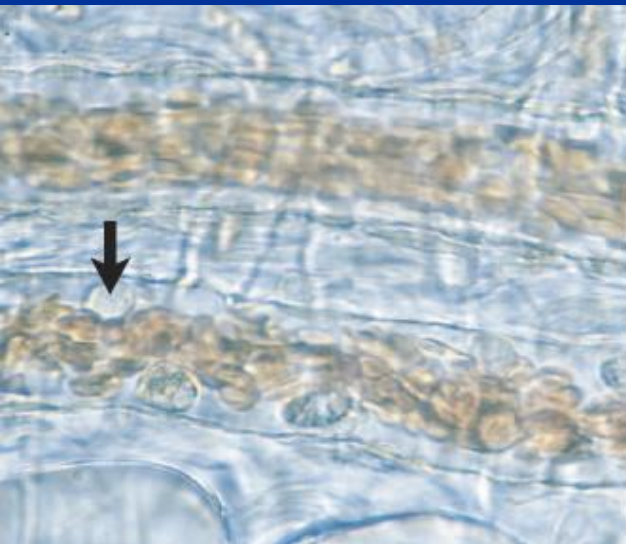
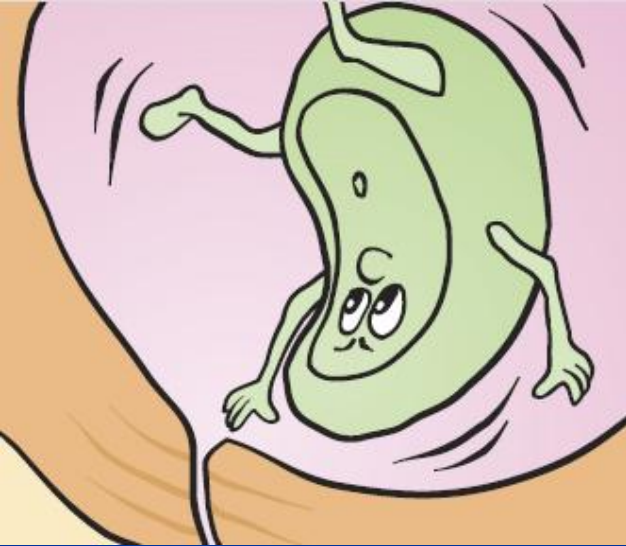
DIRECT INJURY TO ENDOTHELIUM



Inflammation

Chemotactic factors are generated that recruit leukocytes from the vascular compartment and into the injured tissue. Once present in the tissues, recruited leukocytes secrete additional inflammatory mediators that either enhance or inhibit the inflammatory response.

Leukocyte transmigration

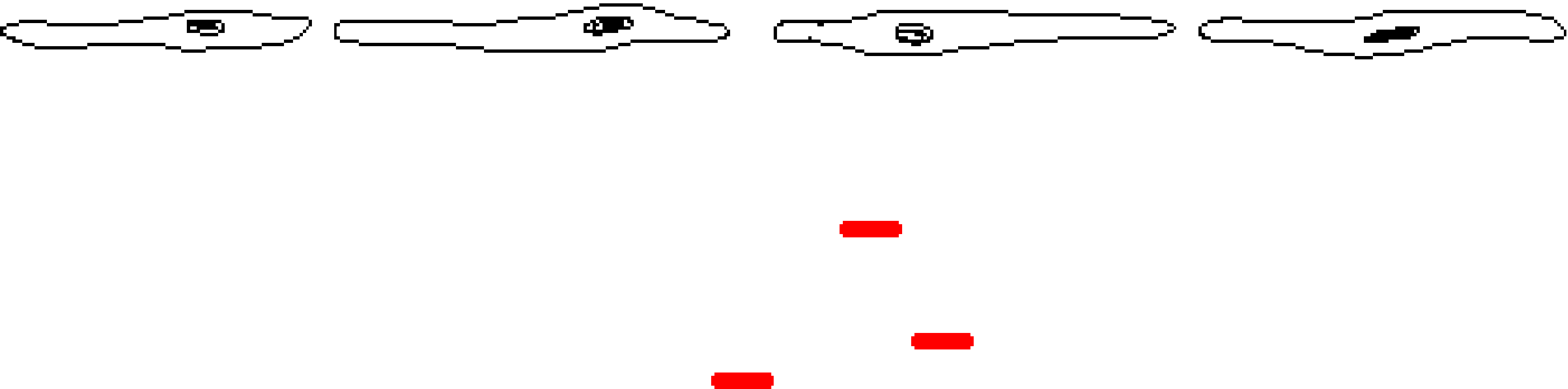
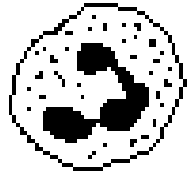


margination

adhesion

diapedesis

MARGINATION

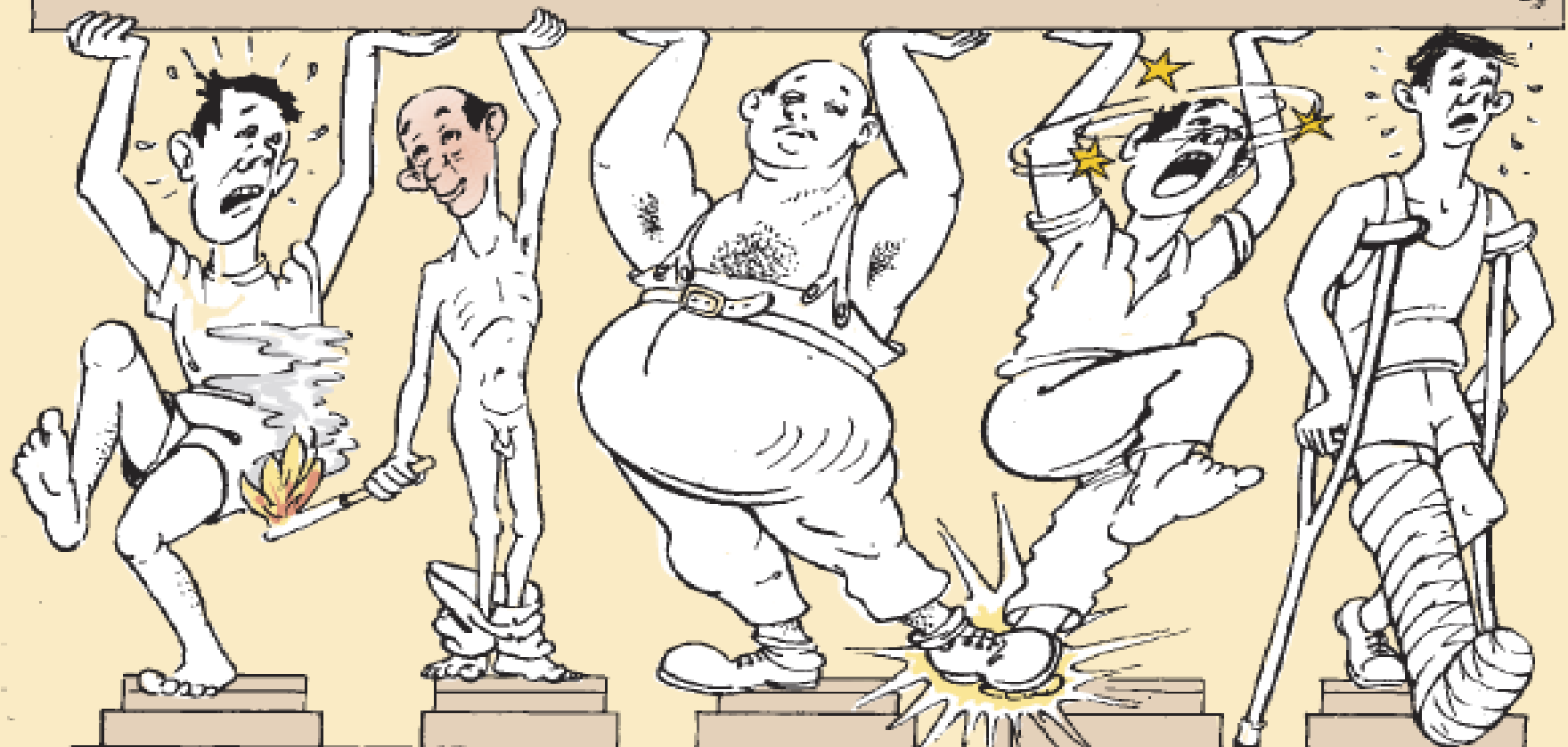


Symptoms of Inflammation

- Inflammation produces local clinical and morphologic changes:
 - — Tumor, inflammatory tissue swelling;
 - — Rubor, inflammatory hyperemic erythema;
 - — Calor, inflammatory heat in the tissue;
 - — Dolor, pain in the inflamed area;
 - — Functio laesa, functional impairment of the inflamed organ or tissue.



INFLAMMATION



Calor

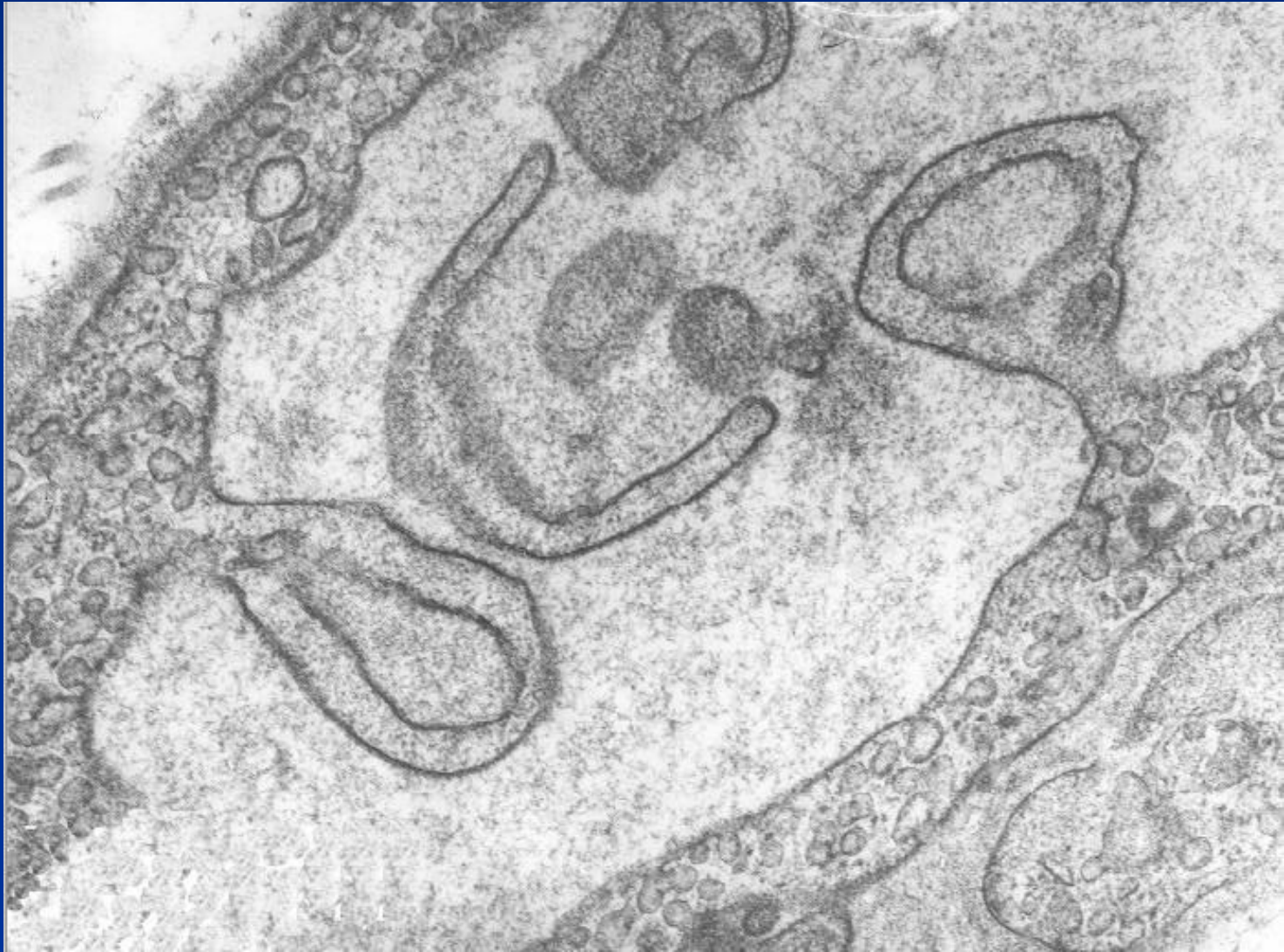
Rubor

Tumor

Dolor

Functio laesa

Pinocytosis in the endothelial cells



Exudative inflammation is classified according to type of exudate:

- **Serous inflammation** (serous exudate)
- **Fibrinous inflammation** (fibrinous exudate):
 - Diphtheritic inflammation
 - Croupous inflammation (croup - film)
- **Suppurative inflammation** (purulent exudate):
 - Phlegmonous inflammation (phlegmona)
 - Abscess
 - Empyema
- **Hemorrhagic inflammation** (hemorrhagic exudate)
- **Mixed inflammation** (mixed exudate)

A **serous** exudate or effusion is characterized by absence of a prominent cellular response and has a yellow, strawlike color.

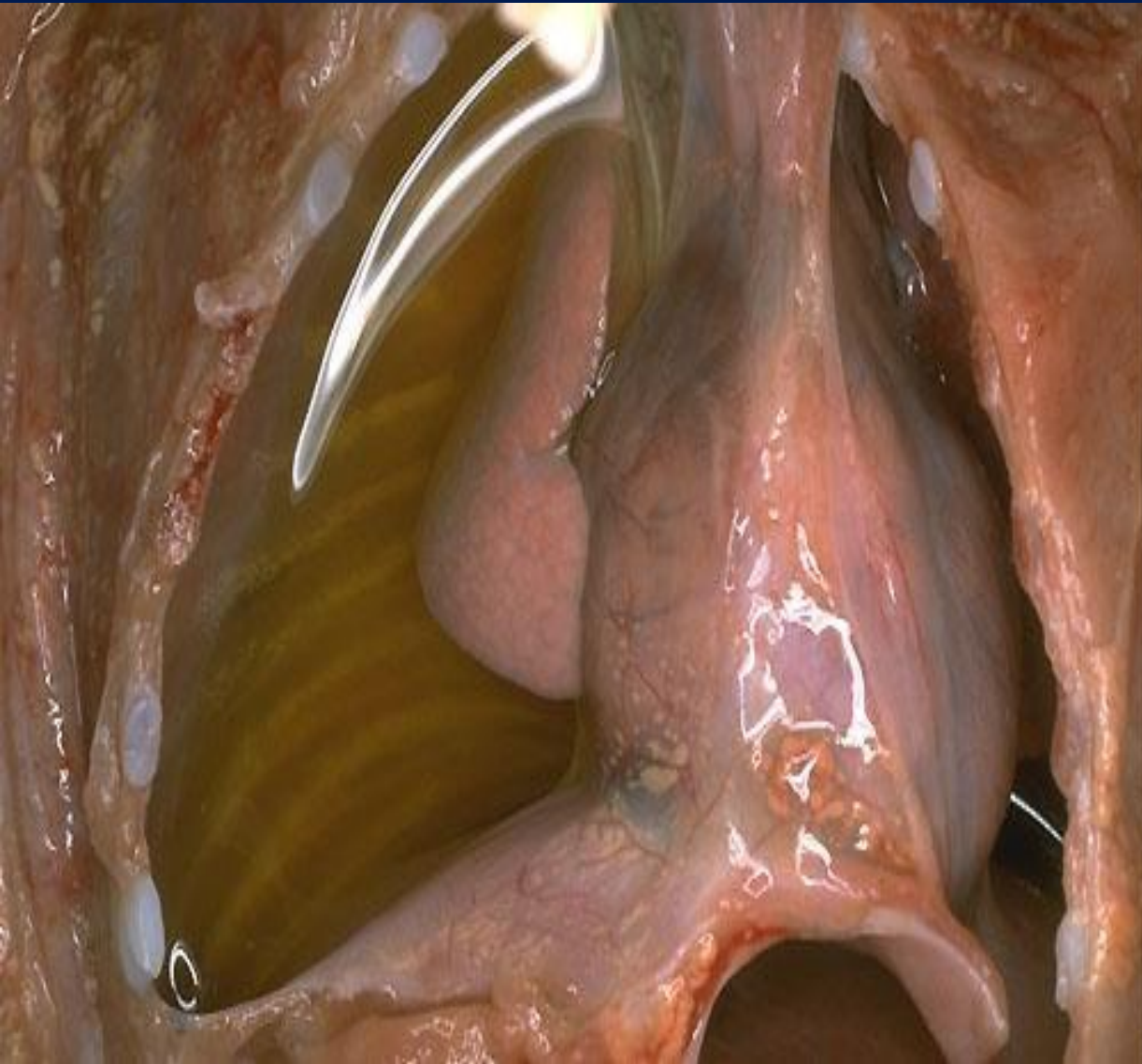
Serosanguinous refers to a serous exudate or effusion that contains erythrocytes and has a red tinge.



Katarrhal collitis.



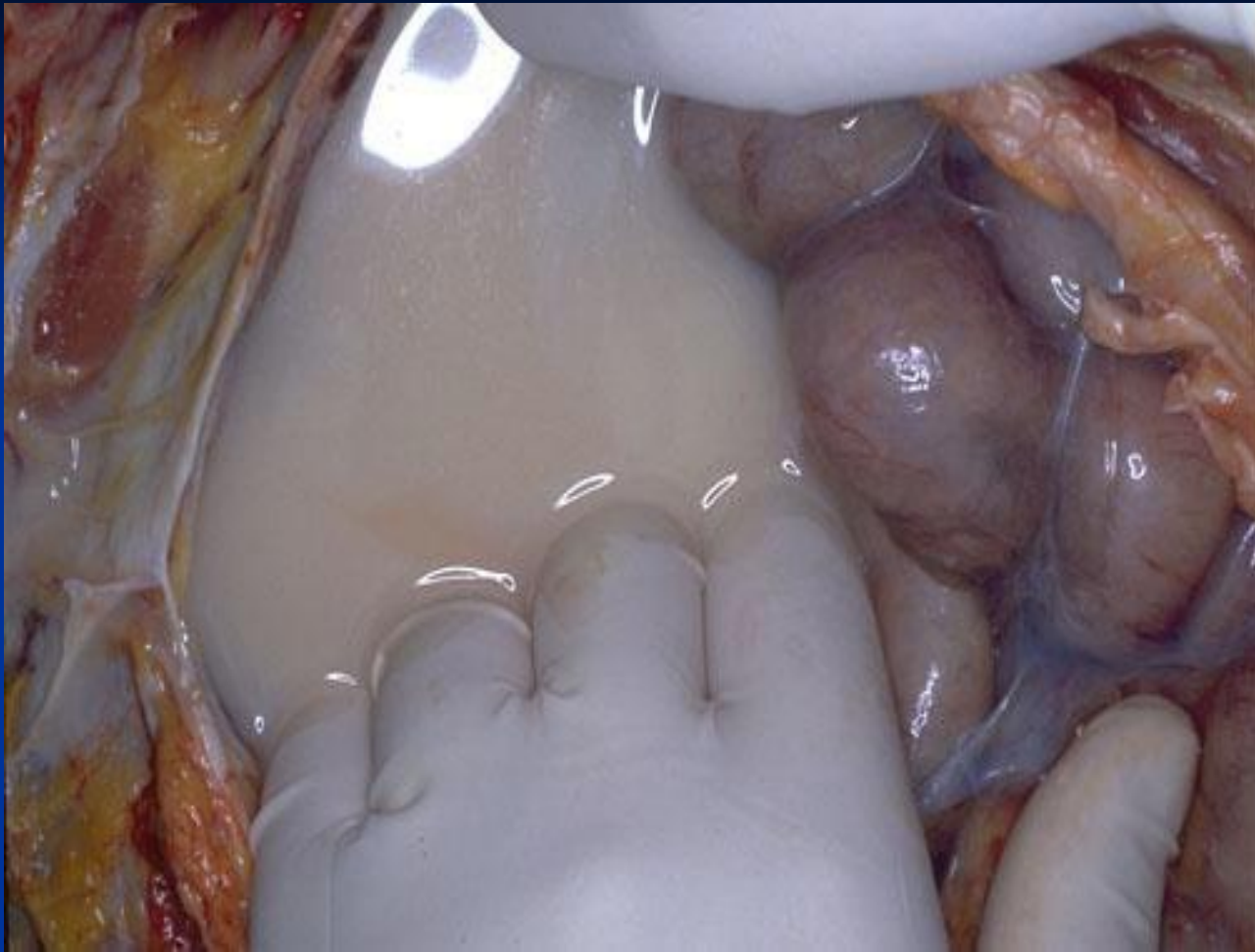
This example of edema with inflammation is not trivial at all: there is marked laryngeal edema such that the airway is narrowed. This is life-threatening. Thus, fluid collections can be serious depending upon their location.



- Here is an example of fluid collection into a body cavity, or an effusion. This is a right pleural effusion (in a baby). Note the clear, pale yellow appearance of the fluid. This is a serous effusion.



Here is an example of bilateral pleural effusions. Note that the fluid appears reddish, because there has been hemorrhage into the effusion. This is a serosanguinous effusion.

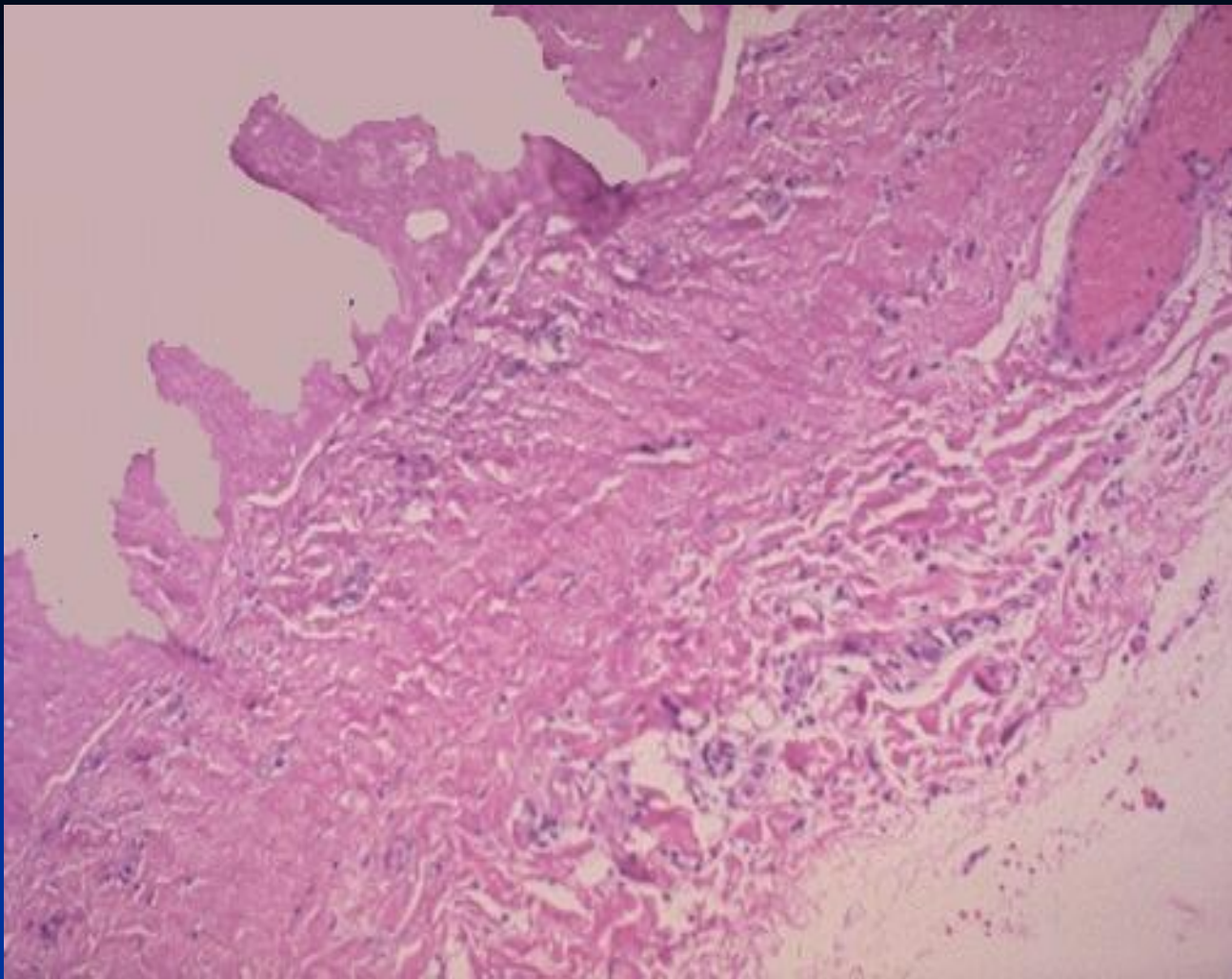


The milky white fluid shown here in the peritoneal cavity represents a chylous ascites. This is an uncommon fluid accumulation that can be due to blockage of lymphatic drainage, in this case by a malignant lymphoma involving the mesentery and retroperitoneum.

A **fibrinous** exudate contains large amounts of fibrin as a result of activation of the coagulation system. When a fibrinous exudate occurs on a serosal surface, such as the pleura or pericardium, it is referred to as fibrinous pleuritis or pericarditis.



The fibrin in this fluid can form a fibrinous exudate on the surfaces. Here, the pericardial cavity has been opened to reveal a fibrinous pericarditis with strands of stringy pale fibrin between visceral and parietal pericardium.

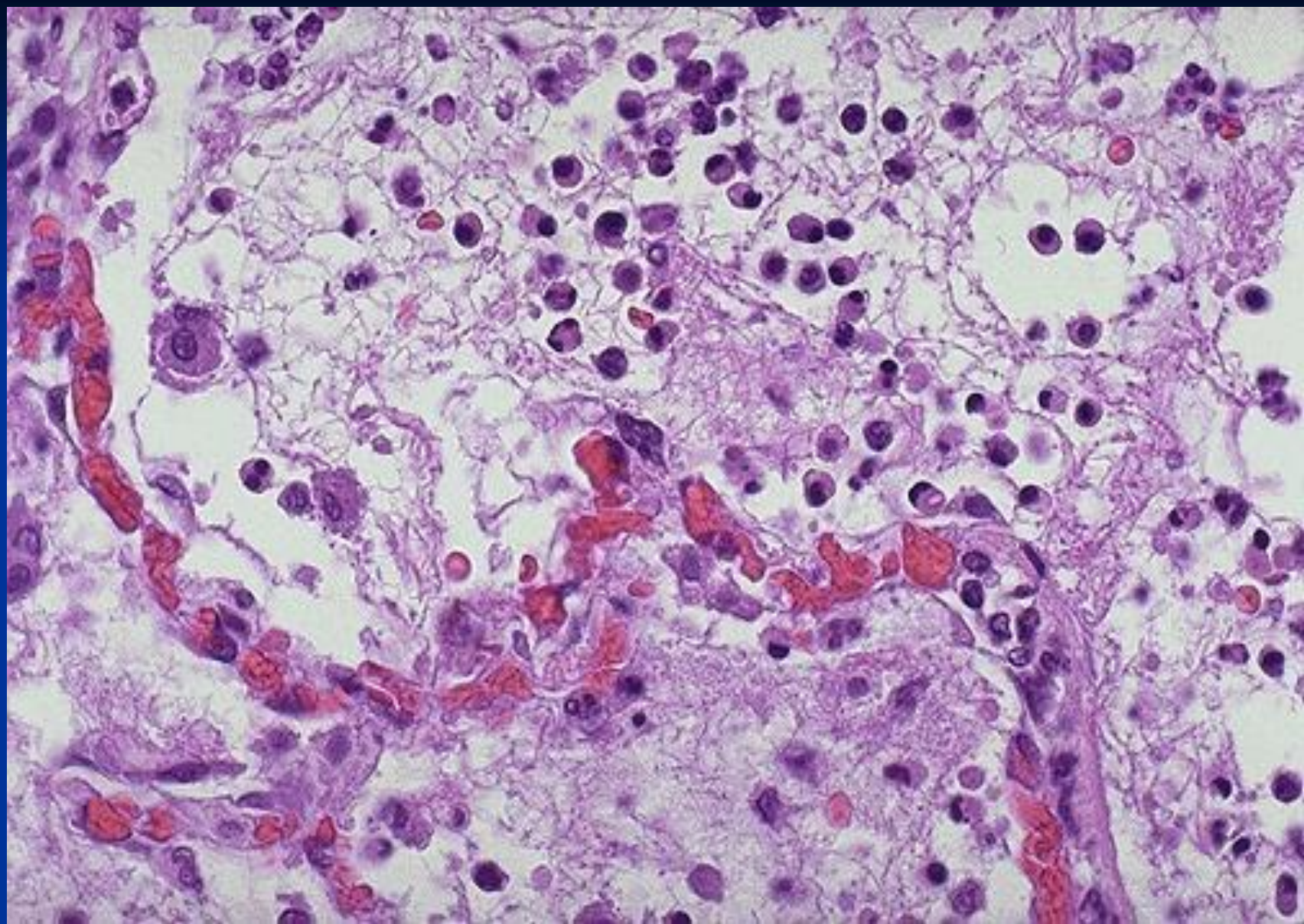


Microscopically, the fibrinous exudate is seen to consist of pink strands of fibrin jutting from the pericardial surface at the upper left. Below this, there are a few scattered inflammatory cells.



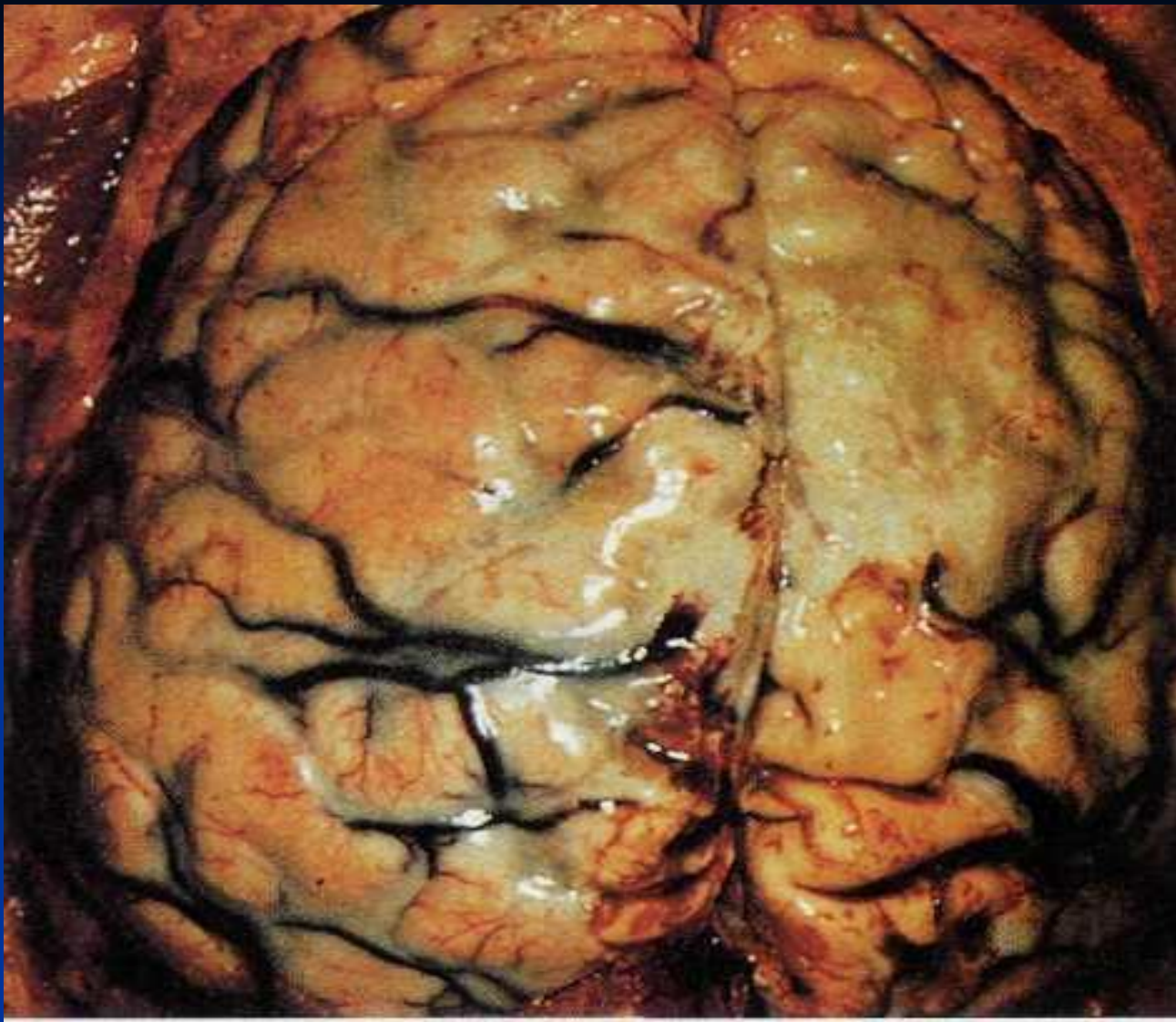
This yellow-green exudate on the surface of an inflamed, hyperemic (erythematous) bowel mucosa consists of many neutrophils along with fibrin and amorphous debris from dying cells.



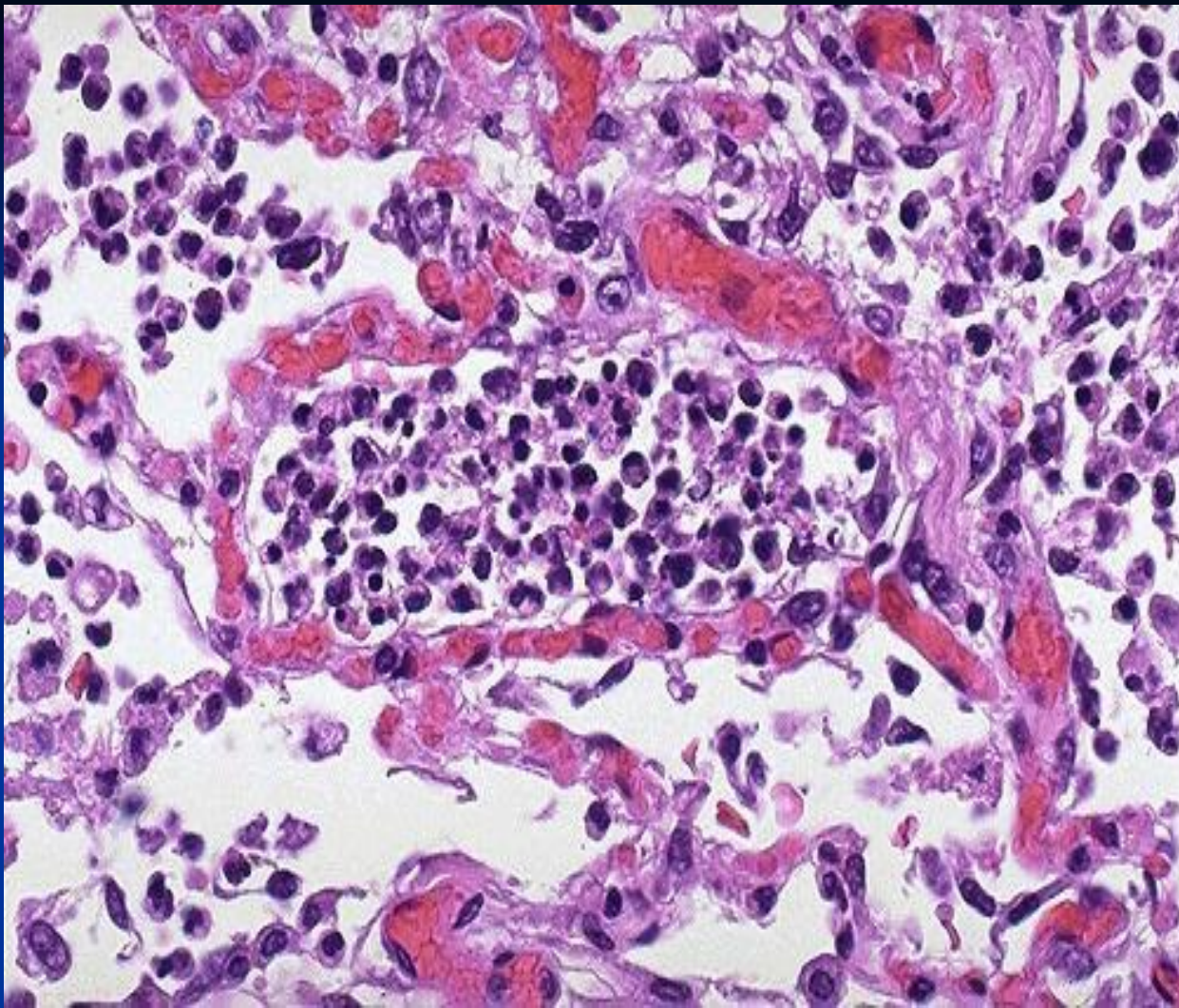


A **purulent** exudate or effusion contains prominent cellular components. Purulent exudates and effusions are frequently identified with pathologic conditions such as pyogenic bacterial infections, in which the predominant cell type is then polymorphonuclear leukocyte.

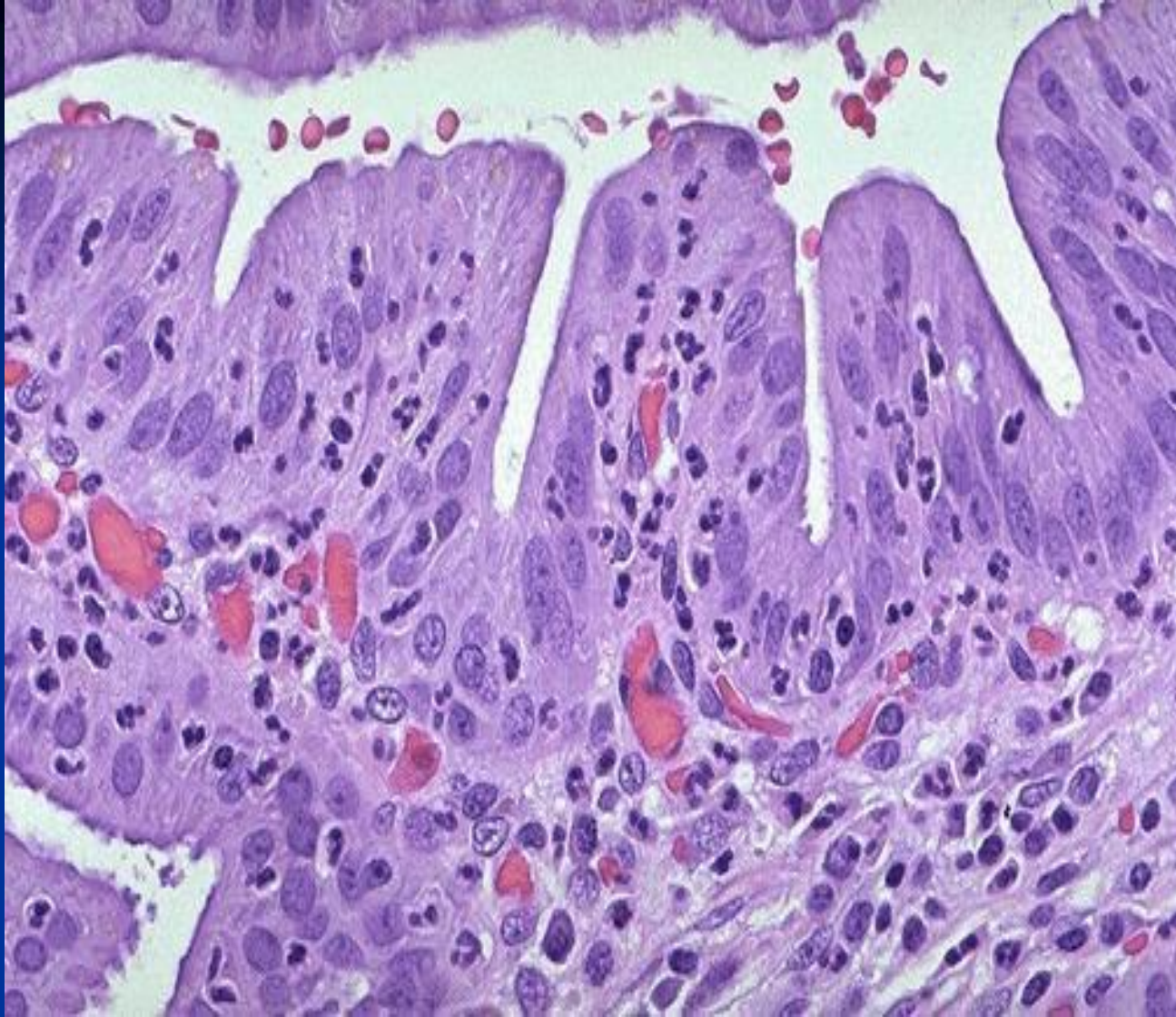
Suppurative inflammation describes a condition in which a purulent exudate is accompanied by significant liquefactive necrosis. It is the equivalent of pus.



Purulent exudate. In this case of bacterial meningitis, a viscous, cream colored, acute inflammatory exudate is present within the subarachnoid space.



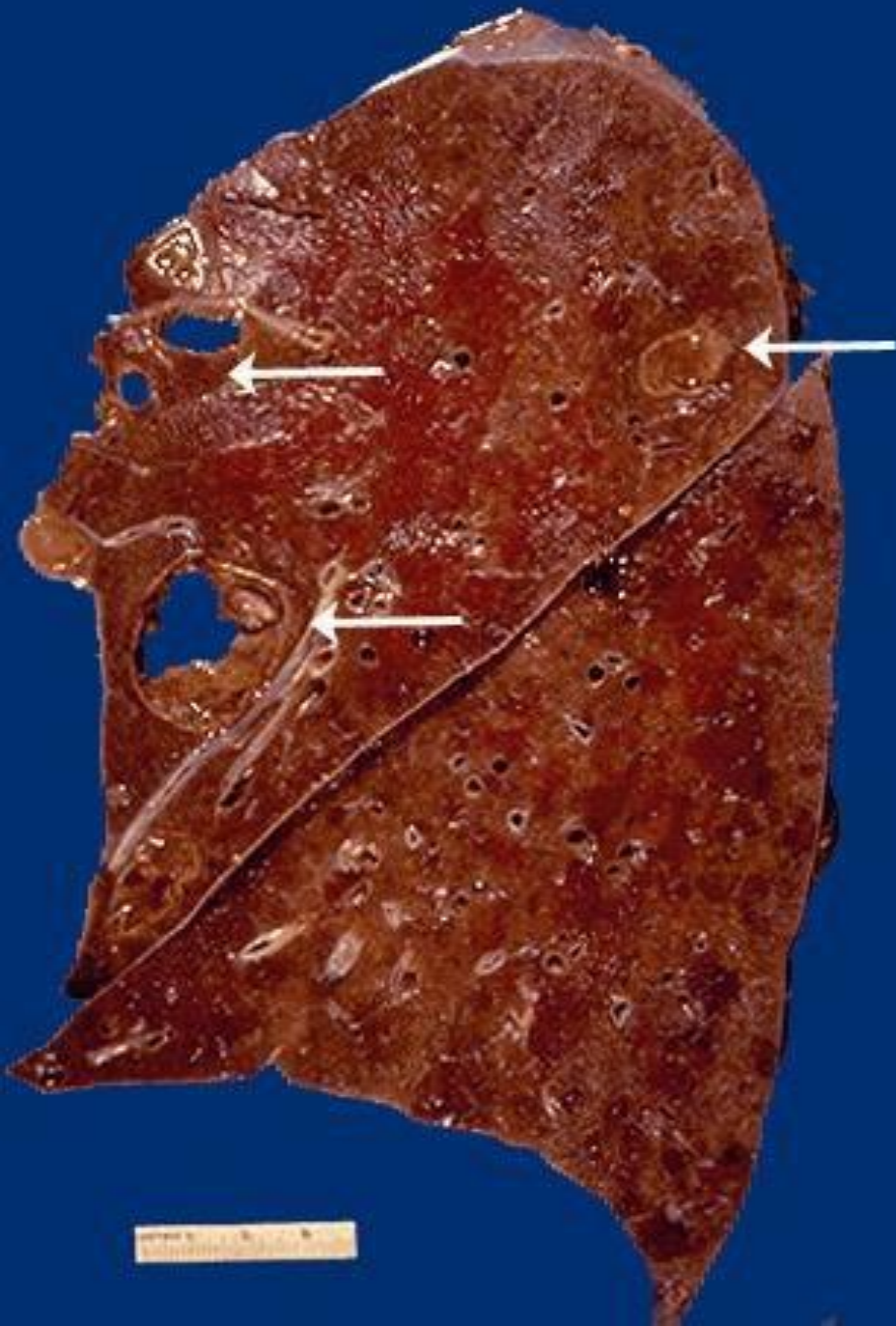
The PMN's seen here are in alveoli, indicative of an acute bronchopneumonia of the lung. The PMN's form an exudate in the alveoli. The source, the neutrophilic alveolar exudate, is seen here.



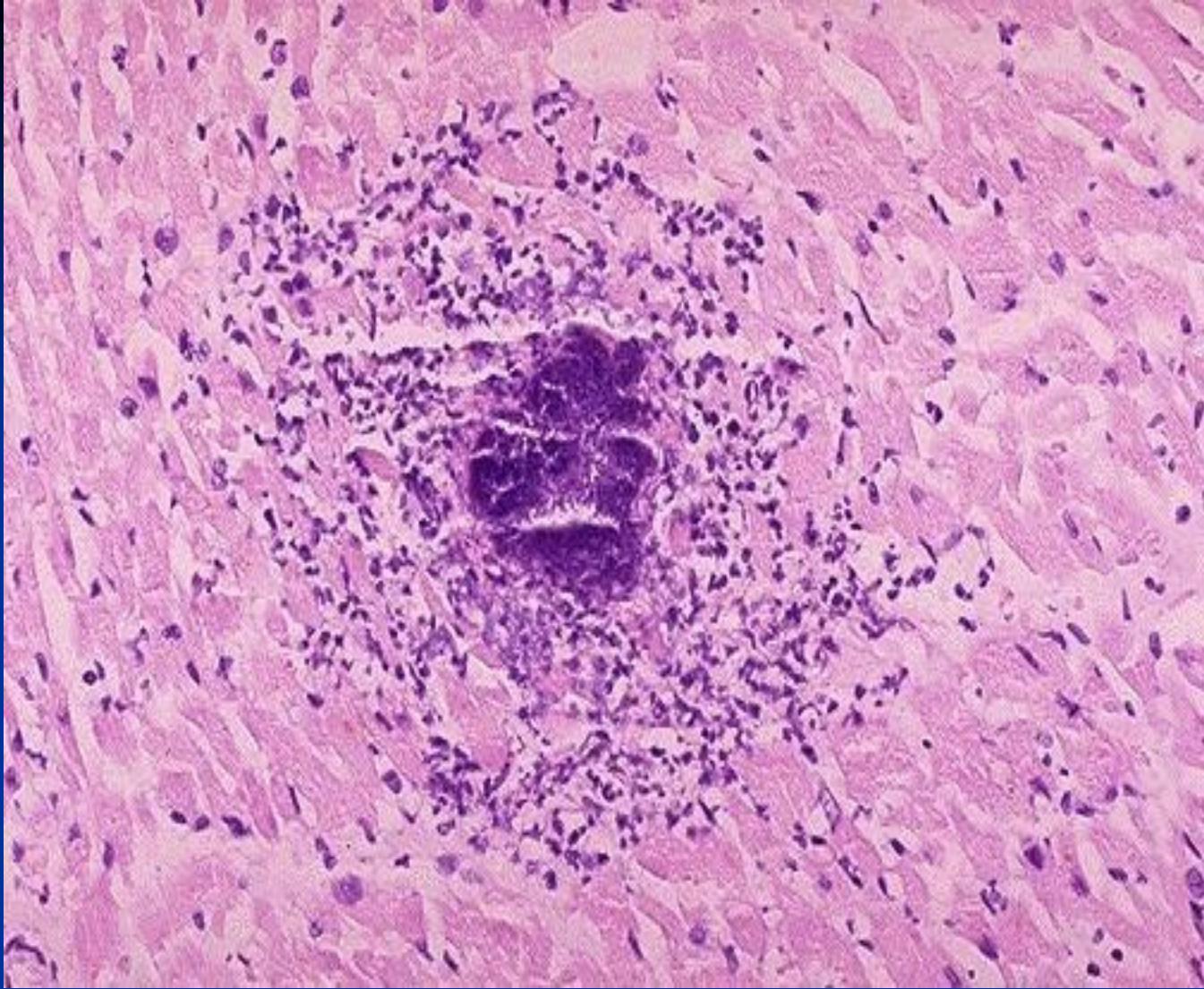
The neutrophils are seen infiltrating the mucosa and submucosa of the gallbladder in this patient with acute cholecystitis.



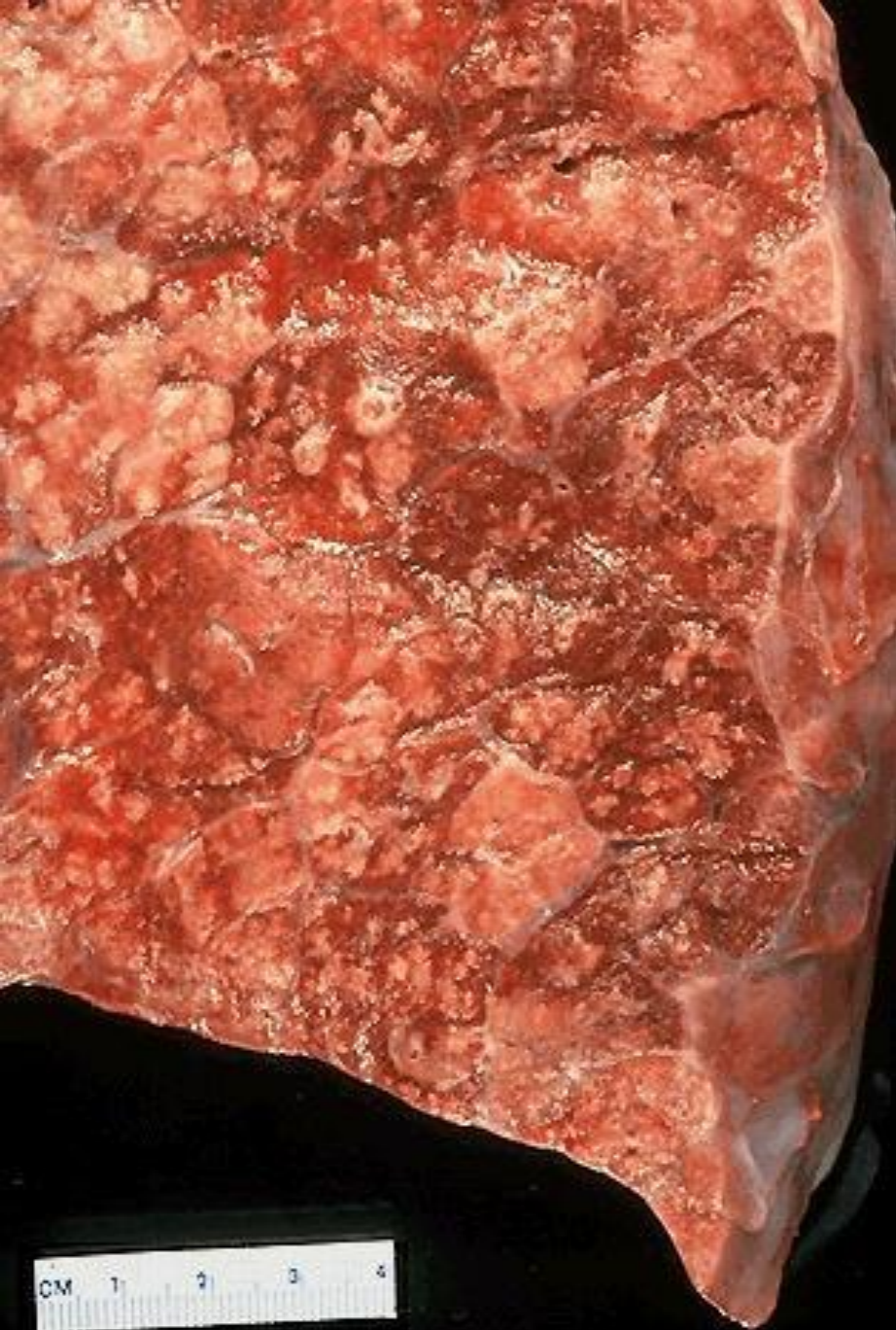
Extensive acute inflammation may lead to abscess formation, as seen here with rounded abscesses (the purulent material has drained out after sectioning to leave a cavity) in upper lobe and lower lobe.



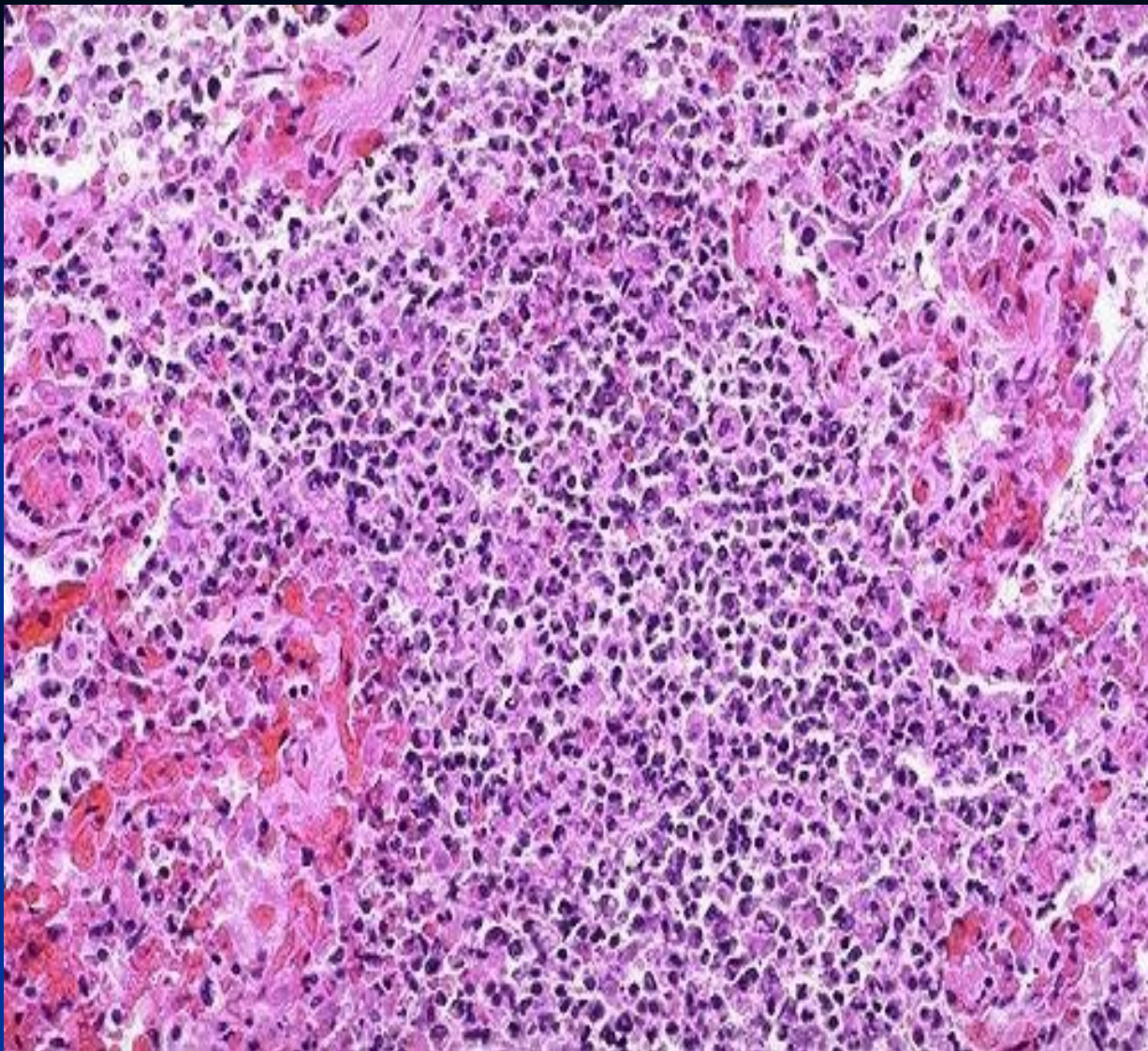
The white arrows mark areas of abscess formation in the upper lobe of this lung. The liquefactive necrosis of an abscess is apparent, because the purulent contents are draining out to leave a cavity. On a chest radiograph, the liquefied central contents of an abscess can appear as an "air-fluid level".



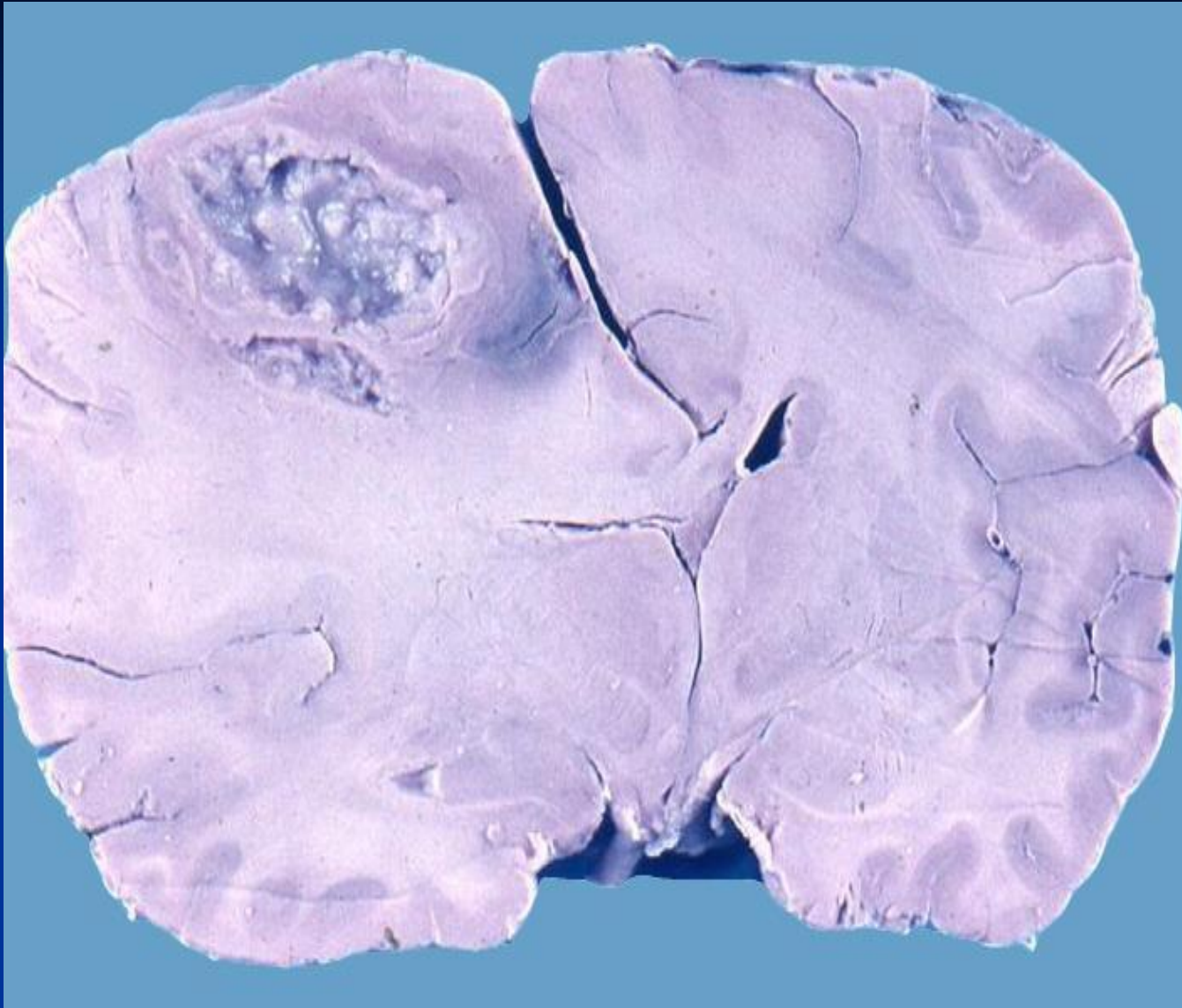
An abscess is a localized collection of PMN's. Here is a microabscess in the myocardium. The irregular dark purple center is a collection of bacteria that are the cause for this abscess.



**This abscessing
bronchopneumonia has
numerous areas of raised,
lighter tan appearance
which are the areas
containing the extensive
neutrophilic infiltrates.**



Microscopically, the extensive neutrophilic exudate of an acute abscessing pneumonia is seen here. Normal tissues are destroyed in the region of the abscess.



Abscess of the brain.

Suppurative nephritis.

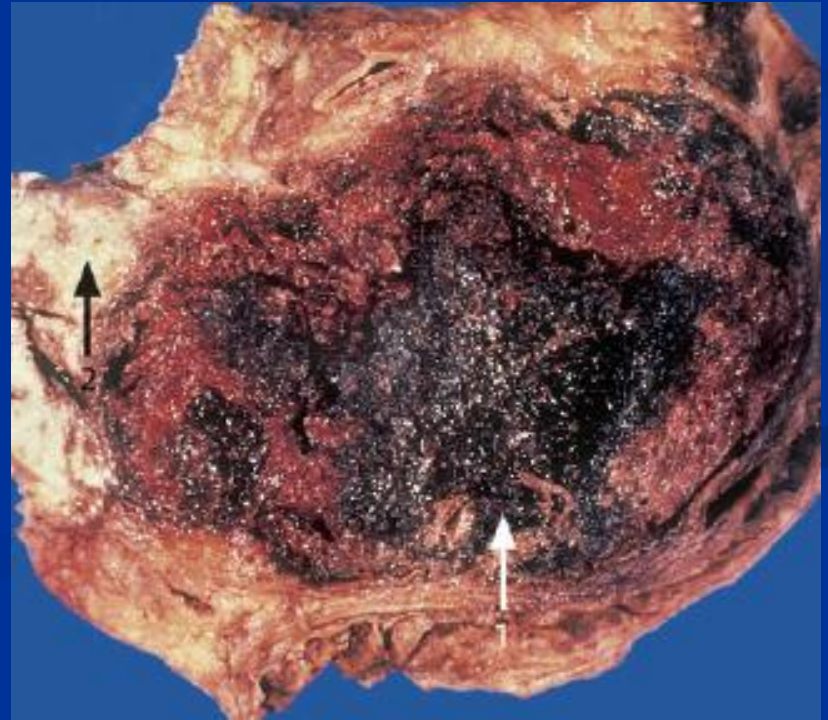
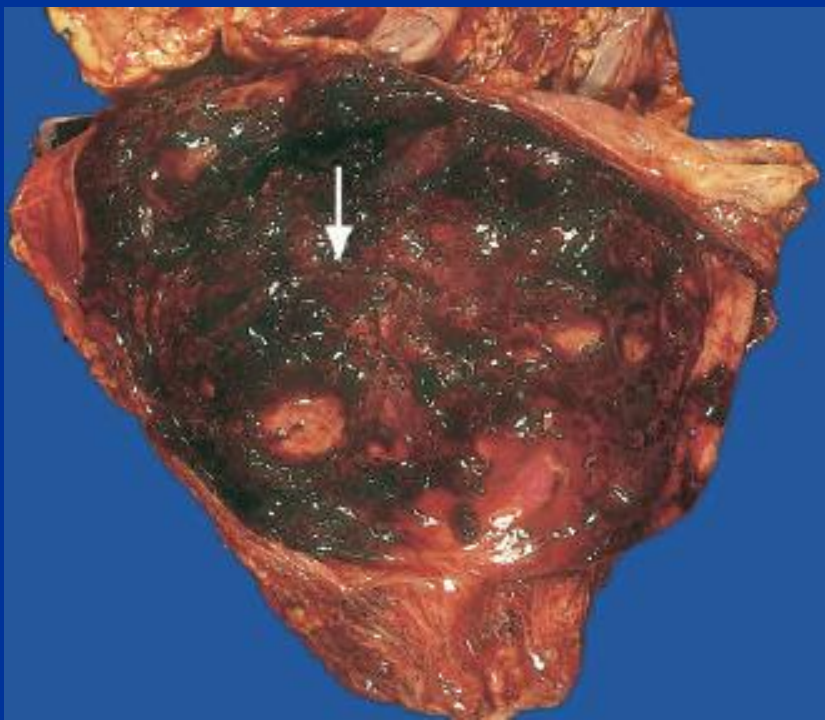
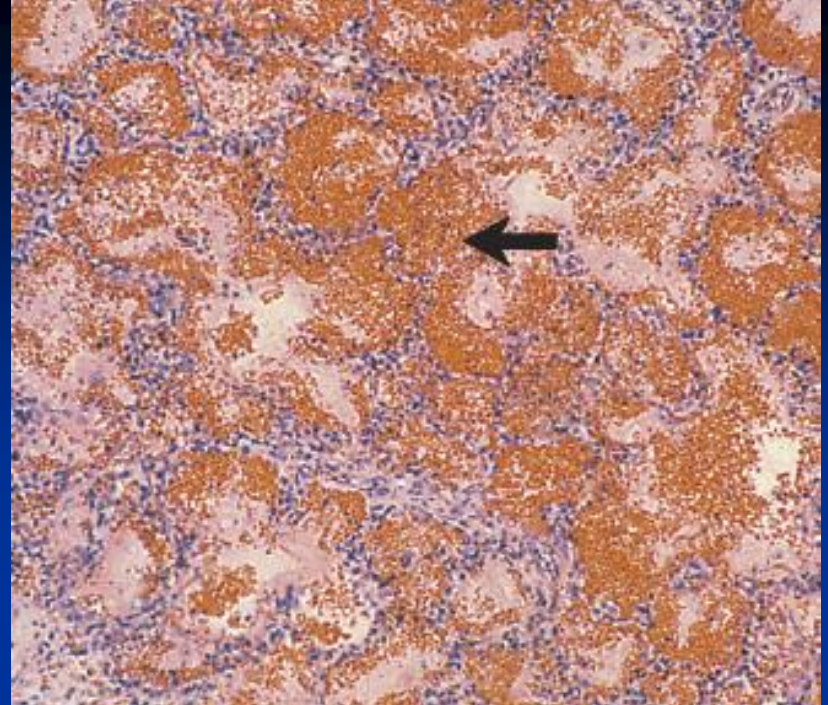
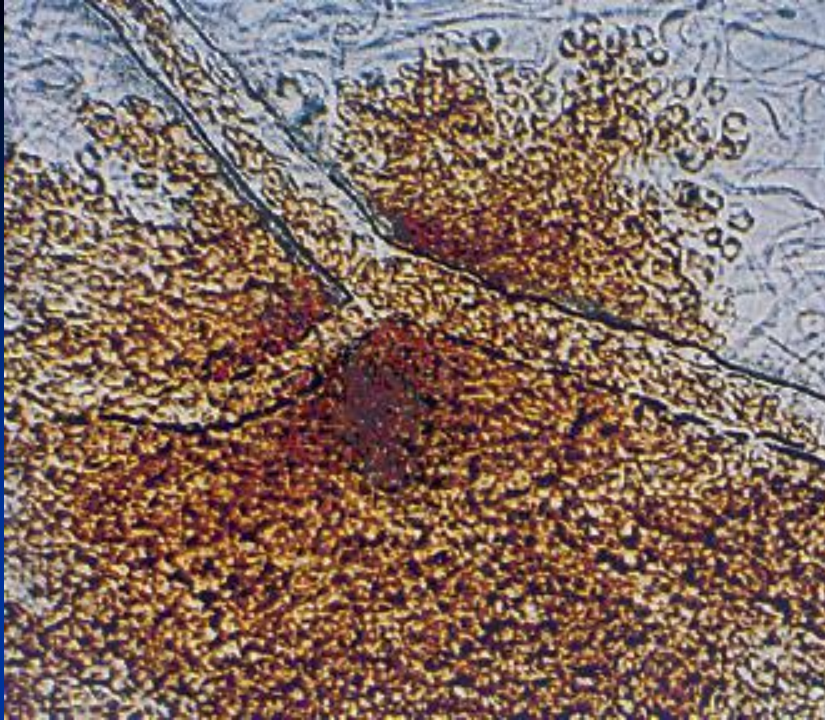




Phlegmona.



Suppurative pericarditis.



Inflammation

